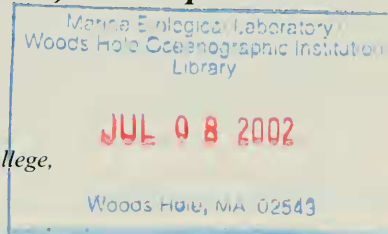


**Five New Chordeumatidan Millipeds from China:  
New Species of *Vieteuma* (Kashmireumatidae) and *Nepalella*  
(Megalotyliidae)**

by

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**Five new species of chordeumatidan millipeds, *Vieteuma longi* (Kashmireumatidae), *Nepalella pianma*, *N. griswoldi*, *N. kavanaughi* and *N. magna* (Megalotyliidae), are described from the Gaolingong Shan, Yunnan Province, China. The new species bring to seven the total number of chordeumatidans described from the Chinese mainland.**

Our knowledge of chordeumatidan millipeds from China is very limited compared to the prospective fauna of that country. No definitive record of the order from China had been published before Mauriés and Nguyen-Duy Jaquemin (1997) recorded a single species, *Vieteuma hubeiensis* (Kashmireumatidae), a troglobite from Shennonghia, Hubei Province. To put this in an entomological perspective, it would be analogous to recording the first butterfly from China in 1997!

More recently, I described a second troglobite, *Nepalella caeca* (Megalotyliidae), from Shuicheng, Guizhou Province (Shear 1999a). That paper summarizes past tentative reports of chordeumatidans from China; Wang and Mauriés (1996) have provided a valuable summary of the myriapodology of China in general. Shear (1999b) discussed chordeumatidan millipeds from Taiwan.

In 1998, the California Academy of Sciences sponsored a collecting trip to China, and a number of chordeumatidan millipeds were collected in Yunnan Province, in and around the Gaolingong Shan. Charles Griswold kindly forwarded them to me for study. Included were four new species of *Nepalella*, and a single new *Vieteuma*, all surface-dwelling forms. It might have been thought more advisable to hold this material and wait for more substantial revisionary work on the two genera, but given the sporadic availability in the west of collections from China, and the scanty information on chordeumatidans there, I've decided to describe the new species quickly. Perhaps this work will stimulate more collecting of this most interesting order of millipeds, and systematic work on them, by Chinese myriapodologists.

Thanks are due the collectors listed below, and especially to Charles Griswold for bringing the specimens to my attention. The habitat descriptions accompanying the species accounts are from notes provided by Dr. Griswold. Specimens are deposited in the Kunming Institute of Zoology (KIZ), Yunnan China, and California Academy of Sciences (CAS), San Francisco, USA. This study was made possible by a grant from the National Science Foundation to the author and Petra Sierwald (NSF DB-9712438). This is contribution 20 from the California Academy of Sciences' Center for Biodiversity Research and Information (CBRI) and contribution 14 from the Academy's China Natural History Project (CNHP).

## SYSTEMATIC ACCOUNT

Order Chordeumatida Koch, 1847  
Suborder Craspedosomatidea Brolemann, 1935  
Superfamily Brannerioidea Cook, 1896  
Family Kashmireumatidae Mauriés 1982  
**Genus *Vieteuma* Golovatch 1984**

This family consists of two genera, *Kashmireuma* Mauriés, of the Himalaya in Kashmir and Nepal, and *Vieteuma* Golovatch, from Vietnam and southern China.

Including the following, *Vieteuma* contains only three species. The generotype, *V. topali* Golovatch, is from Vietnam (Golovatch 1984); it is a very small species with only 26 segments in both sexes. As mentioned above, *V. hubeiensis* Mauriés and Nguyen-Duy Jaquemin is a Chinese troglobite; it has 28 segments. *Vieteuma* females have normal second legs. The posterior gonopod prefemora are strongly lobed, and the seventh legs of the males are slightly modified.

*Kashmireuma* Mauriés contains three Himalayan species, of which *K. schawallari* Shear and *K. nielsenii* Mauriés appear to be closely related, based on similarities of the anterior gonopods and the nearly identical, strongly modified coxae of male legpair 7. *Kashmireuma nepalensis* Mauriés has essentially unmodified legpair 7 coxae and quite different gonopods (Mauriés 1988). All previously described species of *Kashmireuma* have 28 segments. A unique feature among chordeumatidan millipeds is found in this genus: the second legpair of the female is vestigial, reduced to small, unarticulated nubbins on the second sternum. *Kashmireuma* males may have the posterior gonopod prefemora extended distal to the prefemoral/femoral joint, but without the strong lobes seen in *Vieteuma*.

The present species has an anterior gonopod plan which agrees well with that of *V. hubeiensis*, and strongly lobed posterior gonopod coxae typical of *Vieteuma*. Despite this close agreement in male characters, the females have vestigial second legs, as in *Kashmireuma*. Thus we must know a greater range of species in these two genera to properly assess this female character.

Given the three species known, it is now possible to assay at least a preliminary general description of *Vieteuma* gonopods. Much of the bulk of the anterior gonopod is composed of a synangiocoxosternum, a fusion of the sternite and the bodies of the coxae on each side. The sternum generally has some form of mid-line extension, which in the present species takes the shape of two large ensiform processes. The synangiocoxite (formed from the coxal walls) is cupped and bears a subtriangular fimbriated process laterally; this process can be very large, as in *V. hubeiensis*. Posteriorly from one to three pairs of pseudoflagella are present, each with dense fimbriation. The smooth processes emerging from the center of the angiocoxal mass are taken to be colpocoxites (formed from the extruded and sclerotized coxal glands). The presence of articulated telopodites, seen in kashmireumatids, is rare in chordeumatidan anterior gonopods and seems to occur most frequently in cleidogonoids and brannerioids. The posterior gonopods have coxites that are similar in shape in the three known species; the largest part of the gonopod is the prefemur with its thorny lobes. These thorns can be seen under high magnification (400 ×) to be short, stout setae. The reflexed prefemora are usually rather small and probably do not have a glandular function. The trochanteral modifications of legpairs 11–16 have not been described in the other two species.

The cyphopods are unusually formed, with enlarged mesal valves. The curious, reduced, second legpair has already been referred to; this is a character of *Kashmireuma* and is not found in either previously known species of *Vieteuma*. The entire second segment of a female *V. longi* (Fig. 1D) was digested in trypsin, and I found a number of features not previously noted. The reduced second sternum articulates with strong processes extending from the anteroventral margins of the pleurotergites. There are two small, completely fused nubbins on the sternite that represent the vestigial legs. The

sternite also bears two very thin apodemes, but I could not find any sign of a spiracle. The receptacle and valves are sparsely setose (setae are omitted for clarity in Fig. 1D) and their cuticle is scaly. Not shown in the drawing are two small sclerites dorsal and posterior to the cyphopods and embedded in the membrane that ties them to the second sternum; I have no ideas about the homologies of these sclerites.

*Vieteuma longi*, new species

Figure 1

MATERIAL EXAMINED. — Male holotype, 2 male and 4 female paratypes from China, Baoshan Prefecture, pass over Gaolingshan at 2100 m, Nankang, 36 air km SE of Teng Chong (24°50'N, 98°47'E), collected 4–7 November 1998 by C. Griswold, D. Kavanaugh, C-L. Long, holotype and 1 male and 2 female paratypes in KIZ, remainder in CAS; two male, one female paratypes, as above, but pass over Gaolingshan at 2300 m, Luoshuidong, 28 air km E of Teng Chong (24°57'N, 98°45'E), 26–31 October 1998, C. Griswold, D. Kavanaugh, male and female in KIZ, female in CAS.

DIAGNOSIS. — *Vieteuma topali* (Vietnam) is much smaller than the present species and has 26 segments in both sexes; *V. hubeiensis* (Hubei, China) is depigmented and eyeless, whilst the present species has both eyes and pigment.

DESCRIPTION OF MALE. — Twenty-eight segments. Total length about 15 mm, width 1.5 mm; 20–22 large, regular, well-pigmented ocelli in subtriangular eyepatch. Segments subcylindrical, segmental shoulders weakly developed, setae long, acute. Color medium tan-brown, usual darker markings of purplish brown. Pregonopodal legs enlarged; coxae of legpair 7 with mesoposterior angles drawn out into short thornlike processes, slightly excavate on posterior surfaces. Anterior gonopods (Fig. 1A, B) with long, paired sternal processes; angiocoxites cupped, with serrate margins, two densely fimbriated pseudoflagellar branches, additional fimbriated areas; colpocoxites narrow, apically hooked; telopodites single-articled, narrow, with apical setae, inserted laterally but curving posteriorly. Posterior gonopods (Fig. 1C) with small colpocoxites; telopodites with prefemur complexly lobed on anterior side, lobes with specialized, shortened, thornlike setae; femora small, elongate, recurved. Legpair 10 with coxal glands, otherwise unmodified. Legpair 11 with coxal glands; trochanters with sharp, mesal processes, these also on legpair 12 and gradually diminishing back to legpair 16.

DESCRIPTION OF FEMALE. — Nonsexual characters as for male. Cyphopods as in Fig. 1D, second legpair vestigial, second sternum reduced.

ETYMOLOGY. — The name honors C-L. Long, one of the collectors.

NOTES. — *Vieteuma longi* is syntopic with *Nepalella griswoldi*, n. sp., and *N. magna*, n. sp., both described below. The type localities are in severely disturbed, closed-canopy forests dominated by trees of the families Fagaceae, Lauraceae and Theaceae.

Suborder Heterochordeumatidea Shear 2000  
 Superfamily Heterochordeumatoidae Pocock 1894  
 Family Megalotyliidae Golovatch 1978  
**Genus *Nepalella* Shear 1987**

*Nepalella* now consists of 18 species (including the four new ones below) from Nepal, Thailand, Myanmar and southern China (Shear 1987, 1999a; Mauriés 1988). As with the other megalotyliid genus, *Megalotyli* Golovatch, the anterior gonopods are reduced to a sternocoxal plate, from which two lateral pronglike pieces rest in lateral grooves on the anterior faces of the posterior gonopod colpocoxites. Because of seeming similarities in the gonopod plan, megalotyliids have always been considered close to the Conotyliidae, the one discordant character being the presence of coxal glands on the eleventh legpair in the megalotyliids (a plesiomorphic character). In this way megalotyliids are

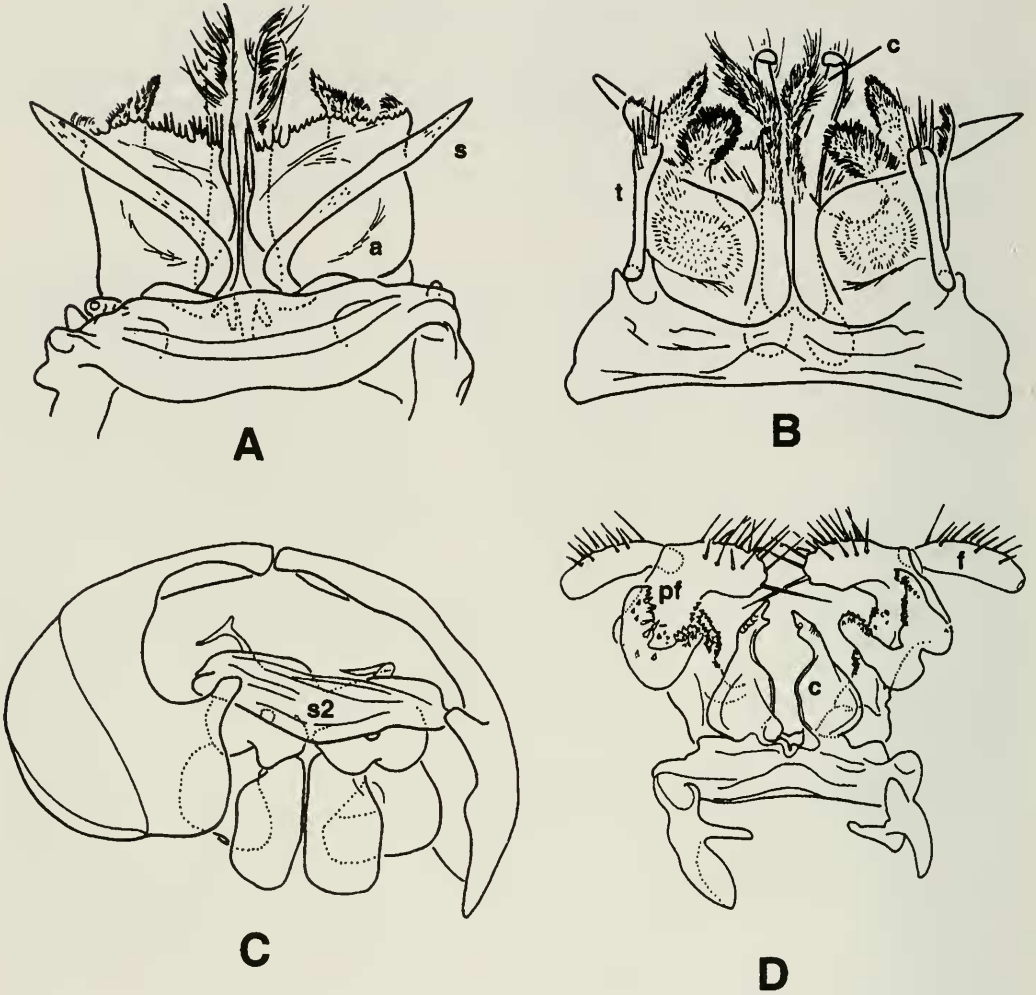


FIGURE 1. *Vieteuma longi*, n. sp. A. Anterior gonopods, anterior view. B. Anterior gonopods, posterior view. C. Posterior gonopods, anterior view. D. Segment 2 of female, anteroventral view. Angiocoxite, a; colpocoxites, c; femur, f; prefemur, pf; sternal process, s; second sternite, s2; telopodite, t.

similar to the Diplomaragnidae (like them, exclusively Asian). Diplomaragnids have a strange gonopod structure: the telopodites of the anterior gonopods are retained (though reduced; this makes the exact homology of these structures questionable) and articulating with a small, T-shaped sternum, pass dorsally to the posterior gonopods and are received in grooves or partially closed pockets on the posterior sides of the posterior gonopod coxites (Shear 1999b). Mauriés (1988) drew attention to a previously unnoticed feature of *Nepalella*: the anterior gonopod coxosternite has a short, platelike projection which extends dorsally between the coxae of the posterior gonopods. This is an intriguing similarity between *Nepalella* and diplomaragnids, not found in any other chordeumatidan millipeds.

*Diplomaragna* Attems is the only genus in its family, but contains more than 30 described species, with the rate of description of new species unabated since 1990. *Nepalella* likewise promises to be a very speciose genus. What is needed to examine any possible relationship between the two genera is material from central and northern China, where, if intermediate forms exist, they will most likely be found.



Enough is now known about *Nepalella* species to be able to describe the general plan of both the male and female genitalia. As already mentioned, the anterior gonopods are strongly reduced, consisting only of a sternocoxal plate with a median lamellate process, and two lateral spikes. The posterior gonopods bear large coxites that are fundamentally bipartite, especially when seen in anterior view. Either of these divisions may be branched or simple; the lateral division is often in the form of a broad, flat plate turned with its axis parallel to the body midline. Posteriorly, there is at least one branch covered with fine cuticular fimbriae, and the entire posterior surface of the coxite may appear densely hairy. The telopodites are typically reduced to a prefemur and femur, the latter turned sharply dorsad; the whole telopodite may be quite small. In typical conotyloids and heterochordeumatoids, the femur is swollen with gland tissue; the gland may debouche through a canal in the coxite. There is no sign of that adaptation in *Nepalella*, indeed the tendency seems to be for the femur to become smaller; a similar trend is found in diplomaragnids, which also appear to lack the glands. The coxae of legpair 10 bear large, spermatophore-forming glands, and the coxae themselves frequently (but not always) carry well-developed processes; this appears to be usual in the Himalayan species, but the Chinese forms so far discovered have essentially unmodified coxae 10. The telopodites of the 10th legs are of normal proportions, but often the whole telopodite is notably smaller than that of the succeeding legs. A gland may be present on coxa 11, or just a small vestigial homolog, sometimes reduced to a shallow depression. Prefemur 11 usually has a dorsally directed hook. The pregonopodal legs are markedly crassate compared to the others, and may have modifications of the prefemora and femora; this differs a great deal from species to species.

The female genitalia are of considerable interest and of obvious taxonomic utility, contrary to the situation in many milliped groups where gender differences between species may be subtle. Many species have a strong clavate process on the operculum, and the valves may bear an array of teeth and lamellae. Frequently the cuticle surrounding the valves is sclerotized and modified; two lateral cuticular processes seem to be developed either from this cuticle or from lateral extensions of the second sternite. The distinctiveness of the female genitalia in this genus makes it acceptable to describe species when only females are available.

### *Nepalella griswoldi*, new species

Figure 2

MATERIAL EXAMINED. — Male holotype, 3 female paratypes from China, Yunnan Prov., Baoshan Prefecture, pass over Gaolingshan at 2300 m, Luoshuidong, 28 air km E of Teng Chong (24°57'N, 98°45'E), 26–31 October 1998, C. Griswold, D. Kavanaugh, holotype and 1 paratype in KIZ, 2 paratypes in CAS; male, 2 female paratypes as above, but pass over Gaolingshan at 2100 m, Nankang, 36 air km SE of Teng Chong (24°50'N, 98°47'E), collected 4–7 November 1998 by C. Griswold, D. Kavanaugh, C-L. Long, female paratype in KIZ, male and female in CAS.

DIAGNOSIS. — The posterior gonopod coxites of this species resemble those of *N. kavanaughi*, n. sp., but the posterior branch is densely fimbriated in *N. griswoldi*.

DESCRIPTION OF MALE. — Total length about 16 mm, width 2.2 mm. Thirty subcylindrical segments with well-developed dorsolateral shoulders; segmental setae short and acute. Ocelli 25, round and well-pigmented, in triangular eyepatch. Color medium brown, mottled darker purplish brown in usual chordeumatidan pattern. Legpairs 3–7 enlarged; femur 4 with distal knob subtending distinct depression on mesal side. Anterior gonopods (Fig. 2A) as usual for *Nepalella*. Posterior gonopods (Fig. 2A, B) with large, robust coxites apically divided, lateral branches flattened, turned with broad planes parallel to body axis, mesal branches acute, curved, bearing indistinct internal channels; large, thick processes dorsally directed from base of lateral branches; posterior branches and most of posterior surfaces covered in fine cuticular fimbriae; telopodites of normal size but prefemora notably reduced. Legpair 10 with coxal glands, coxae laterally elongate, prefemora swollen, with dorsally

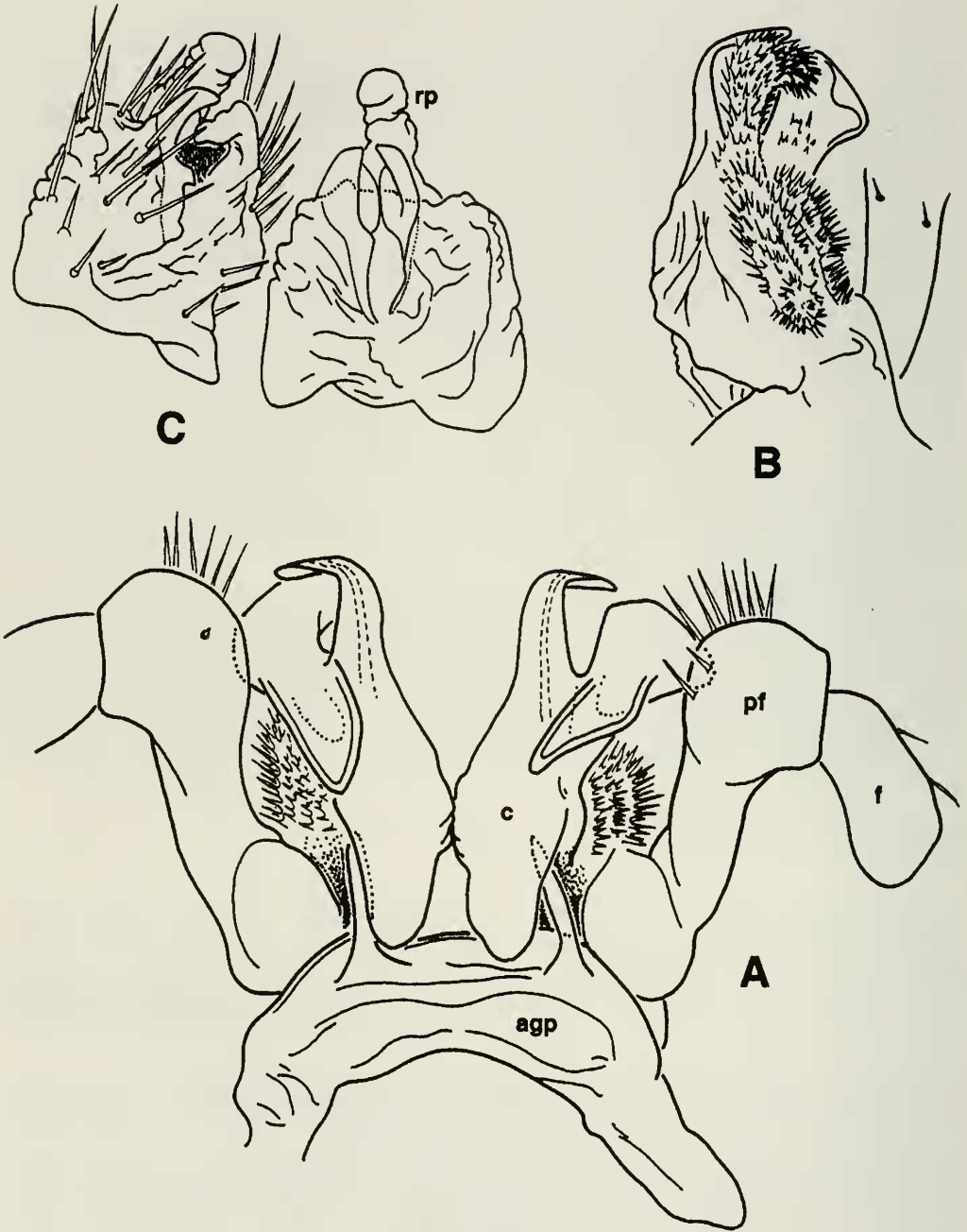


FIGURE 2. *Nepaella griswoldi*, n. sp. A. Gonopods, anterior view. B. Right posterior gonopod coxite, posterior view. C. Cyphopods, ventral view (setae not shown on right side). Anterior gonopods, **agp**: colpocoxites, **c**: femur, **f**: prefemur, **pf**: receptacle process, **rp**.

directed proximal knobs. Legpair 11 with coxal glands replaced by convex area of finely papillate transparent cuticle, prefemora with dorsally directed proximal hooks.

DESCRIPTION OF FEMALE. — Nonsexual characters as in male. Cyphopods (Fig. 2C) with projections from valves, receptacle drawn out into blunt process.

ETYMOLOGY. — The species epithet honors Charles Griswold.

NOTES. — The vestigial gland of legpair 11 has been noted and illustrated for *N. birmanica* by Mauriés (1988). *Nepallela birmanica* in several ways bridges the morphological gap between the Chinese and the Himalayan species of the genus. This species is syntopic with *Vietenna longi*, n. sp., described above; see the habitat notes under the description of the preceding species.

### *Nepallela pianma*, new species

Figure 3

MATERIAL EXAMINED. — Male holotype from China, Yunnan Prov., Nujiang Pref., native forest at 2500 m elevation in Gaolingshan at 9.5 road km ESE of Pianma (25°59'N, 98°40'E), collected 13–18 October 1998 by C. Griswold, D. Kavanaugh, and C-L. Long, deposited in KIZ.

DIAGNOSIS. — Distinct from all previously described species of *Nepallela* in the extreme reduction in size of the posterior gonopod telopodites.

DESCRIPTION OF MALE. — Total length about 14 mm, width 1.5 mm. Thirty segments with moderately developed dorsolateral shoulders, segmental setae short, blunt. Eyepatch triangular, with 24–25 well-formed, pigmented ocelli. Color uniform light brown.

Pregonopodal legs crassate, but without further modifications. Anterior gonopods (Fig. 3A) as usual for the genus; posterior gonopods (Fig. 3A, B) with large coxites bearing arcuate lateral excavations lined by small teeth, posteriorly with single moderately developed fimbriate branch, telopodites much reduced. Legpair 10 with large glands but coxae not conspicuously enlarged or modified; legpair 11 with very small, probably vestigial, glands, coxae not enlarged, prefemora with dorsally directed posterioproximal hooks.

Female unknown.

ETYMOLOGY. — The species epithet is a noun in apposition, after the type locality.

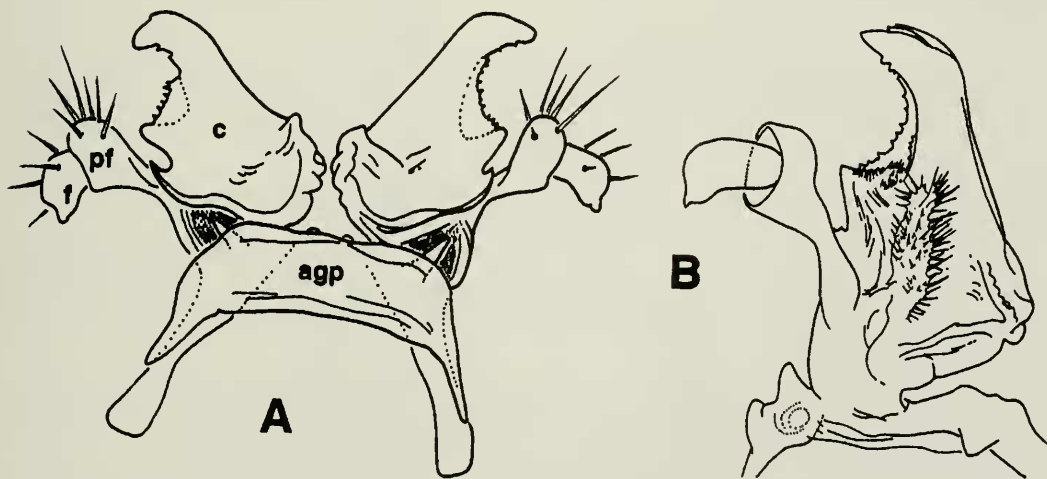


FIGURE 3. *Nepallela pianma*, n. sp. A. Gonopods, anterior view. B. Right posterior gonopod coxite, posterior view. Anterior gonopods, agp; colpocoxites, c; femur, f; prefemur, pf.

NOTES. — This species is syntopic with *Nepallela kavanaughii*, n. sp., described below. The Pianma forest is similar to that already described, with oaks, tanbarks, chinquapins, etc., predominating, but at this higher-elevation site maples, ashes and giant rhododendrons were more prominent. This forest was only slightly disturbed by human activity.

***Nepallela kavanaughii*, new species**

Figure 4

MATERIAL EXAMINED. — Male holotype, male and four female paratypes from China, Yunnan Prov., Nujiang Pref., native forest at 2500 m elevation in Gaolingshan at 9.5 road km ESE of Pianma (25°59'N, 98°40'E), collected 13–18 October 1998 by C. Griswold, D. Kavanaugh, and C-L. Long, holotype and 2 female paratypes in KIZ, male and 2 female paratypes in CAS.

DIAGNOSIS. — The posterior gonopod coxites resemble those of *N. griswoldi*, but are markedly less fimbriate posteriorly; the dorsally enlarged prefemora of legpairs 3–7 are unique in the genus, as is the lack of a prefemoral process on legpair 11.

DESCRIPTION OF MALE. — Total length about 14 mm, width 1.8–2.0 mm. Thirty subcylindrical segments with strongly developed dorsolateral shoulders, segmental setae moderately long, acute. Color even medium brown with darker markings on anterior segments and head. Ocelli 25, black, in subtriangular eyepatch. Legpairs 3–7 crassate, prefemora with swollen dorsal sides (Fig. 4A). Anterior gonopods typical for genus (Fig. 4B). Posterior gonopod coxites (Fig. 4B, C) with two anterior branches; single posterior branch blunt, not fimbriated; telopodites of normal size for genus. Legpair 10 (Fig. 4D) with coxal glands, coxae slightly elongate above gland, telopodites of reduced size but complete and proportionate. Legpair 11 (Fig. 4D) with vestigial glands as described for *N. griswoldi*, but lacking prefemoral processes.

DESCRIPTION OF FEMALE. — Nonsexual characters as in male. Cyphopods (Fig. 4E) with valvular processes reduced, receptacle process unusually long, well-sclerotized; entire cyphopod complex encased in sclerotized extensions of sternum 2, extensions drawn out ventrally into blunt blades.

NOTES. — This species is syntopic with *N. pianma*, n. sp., described above. See the habitat notes under that species.

***Nepallela magna*, new species**

Figure 5

MATERIAL EXAMINED. — Female holotype, 3 female paratypes from China, Yunnan Prov., Baoshan Prefecture, pass over Gaolingshan at 2300 m, Luoshuidong, 28 air km E of Teng Chong (24°57'N, 98°45'E), 26–31 October 1998, C. Griswold, D. Kavanaugh, holotype and 1 paratype in KIZ, 2 paratypes in CAS.

DIAGNOSIS. — Distinct from other Chinese *Nepallela* in its large size (about 30% larger than any known species) and in details of the cyphopods, as depicted in Figure 5.

DESCRIPTION OF FEMALE. — Total length about 33 mm, width 3.0 mm. Thirty subcylindrical segments with moderately developed shoulders; setae short, acute. Twenty-five large, black ocelli form triangular eyepatch. Color dark brown, heavily marked in typical chordeumatidan fashion with darker, purplish brown.

Cyphopods (Fig. 5) with distinct valvular processes; receptacle processes expanded distally, curving posteriorly over valves. Sternum 2 with large, crenulate knob extending between pairs of valves, laterally and posteriorly around cyphopods, bearing long, thin, acute processes. In undissected animals, these processes lie between third leg coxae and third sternite.

Male unknown.

ETYMOLOGY. — The species epithet is an adjective referring to the great size of this species.



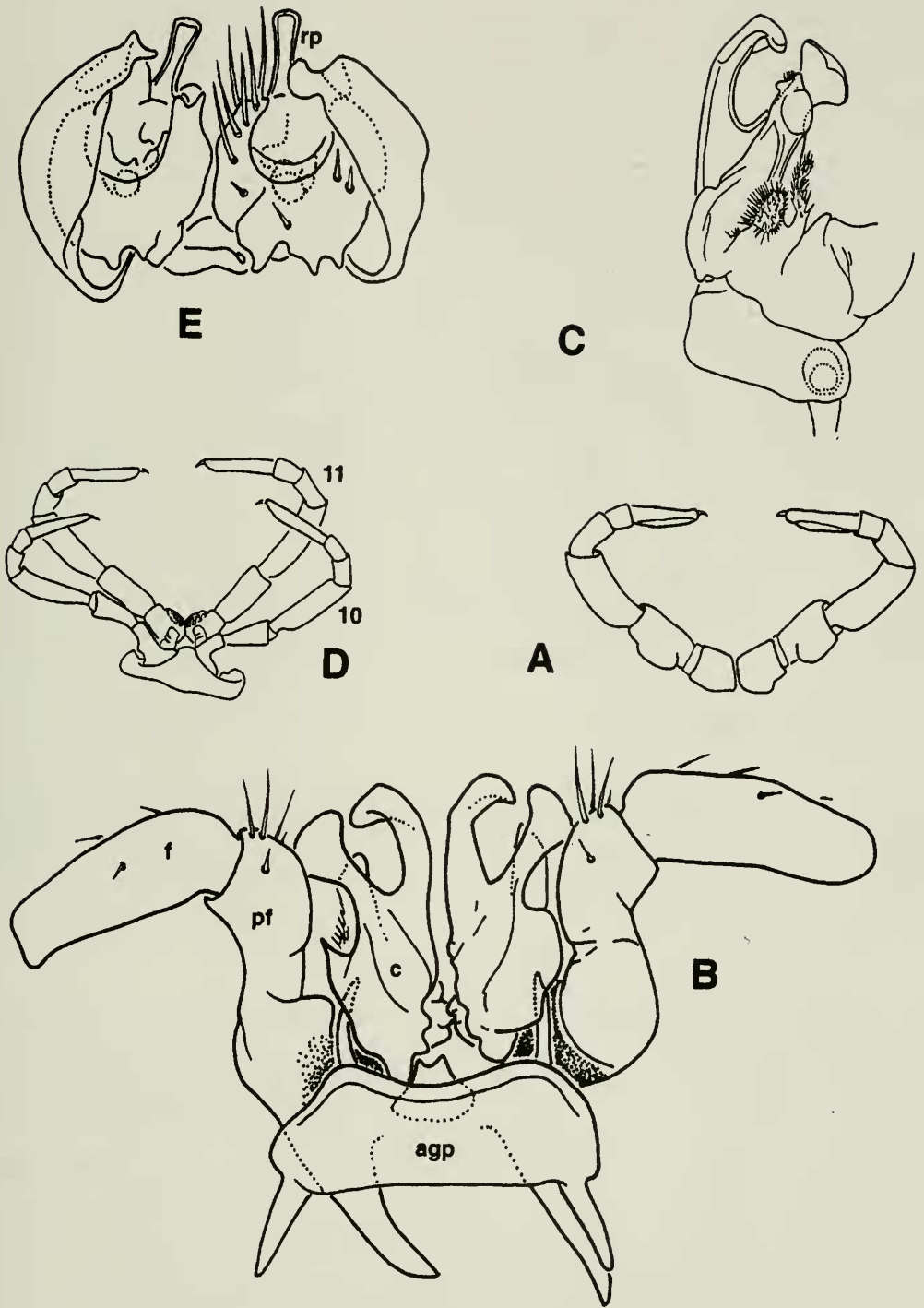


FIGURE 4. *Nepalella kavanaughi*, n. sp. A. Legpair 3 of male, posterior view. B. Gonopods, anterior view. C. Right posterior gonopod coxite, posterior view. D. Legpairs 10 (foreground) and 11 of male, anterior view. E. Cyphopods, ventral view. Anterior gonopods, **agp**: colpocoxites, **c**: femur, **f**: prefemur, **pf**: receptacle process, **rp**: numbers indicate legpair numbers.

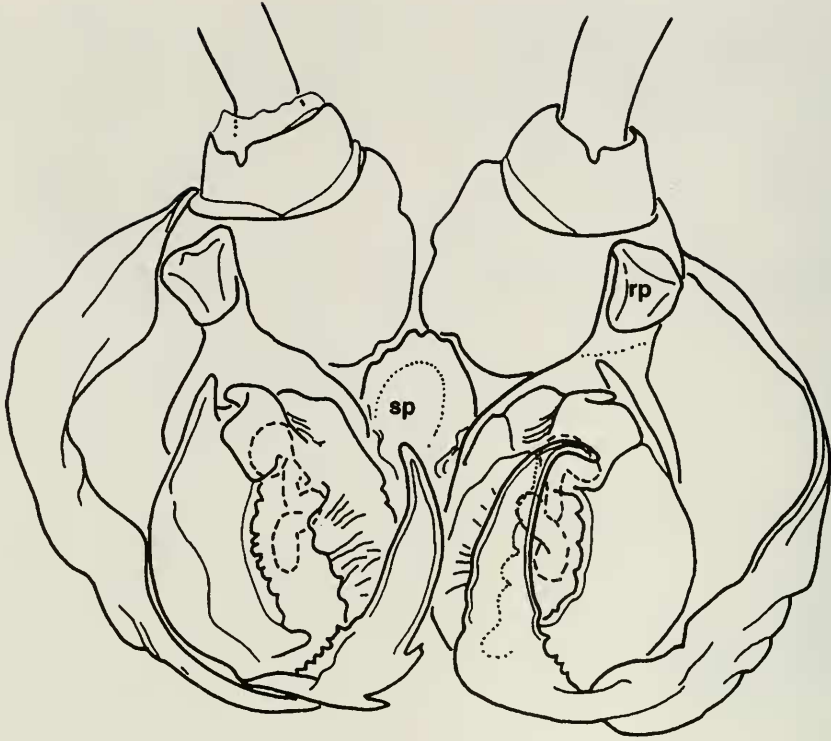


FIGURE 5. Cyphopods of *Nepalella magna*, n. sp., ventral view. Receptacle process, **rp**; sternal process, **sp**.

NOTES. — I have taken the unusual step of describing this species without males because of the distinctiveness of the cyphopods, which bear the characteristic receptacle process found in *Nepalella*, and the unusually large size, which will make it possible to recognize males when they are collected. This species is syntopic with *Nepalella griswoldi* at their common type locality, and with *Vietenna longi*. The habitat was described under the latter species.

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